transverse to the axis of the jaw. In the selenodont Diplarthra, where the thrust is transverse to the line of the jaw, the crescents are longitudinal. That similar effects should accompany similar movements in two groups of Mammalia so widely separated as these two, is strong evidence in favor of the belief that the two facts stand in the relation of cause and effect (Fig. 9, Figs. *b* and *d*).

DESCRIPTION OF A SUPPOSED NEW SPECIES OF ACINETAN, WITH OBSERVATIONS ON ITS MANNER OF FOOD INGESTION AND REPRODUCTION.

BY C. C. NUTTING.

PODOPHRYA COMPRESSA Nutting.

DESCRIPTION:—Body illoricate, quadrate, wider anteriorly; length from two to five times the greatest width; compressed, about three times as wide as thick; the anterolateral corners occupied by rounded prominences, each bearing a fascicle of many suctorial tentacles which, when fully extended, are more than half the length of the body, and spiral or spirally marked when retracted; posterior portion of body rapidly narrowing to meet the very short thick pedicle which is furnished with a sucking disk at its distal end; parenchyma densely and evenly granular; contractile vacuole single, anterior; endoplast oval.

Length of body, 1–277″ to 1–140″.

Habitat. Fresh water.

The above-described species has recently been numerous in a fresh-water aquarium in the Biological Laboratory of the State University of Iowa, where it was first noticed by Professor S. Calvin, who kindly delegated its investigation and description to the writer.

In general appearance it somewhat resembles certain species of the genus *Acineta*, but the absence of any indication of a lorica excludes it from that group, and it is hence, with some doubt, placed in the genus *Podophrya*, with which it agrees in possessing distinctly capitate, fasciculated, suctorial tentacles only. It is

more like *P. buckii* than any other species heretofore described, but differs from it in possessing a distinctly compressed instead of cylindrical body, and in having a distinct, though short and thick pedicle.

Whether this is a new species or not, the observations made on its food ingestion and reproduction are, perhaps, of sufficient interest to justify publication.

Although in two instances this animal was observed to capture ciliated Infusorians, its preference is decidedly for the Amœba, which are abundant in the aquarium referred to. No sooner does an Amœba come within reach of the long suctorial tentacles of the Acinetan than the dish-shaped suckers fasten firmly on their prey and draw it nearer to the body of the captor. On some occasions the capture and subsequent ingestion were observed to be effected by one tentacle only, while on others many were employed in the operation. In one instance three Amœba were held and ingested at once (Fig. 1).

The ectosarc is soon punctured, *how* we could not discover, and almost immediately the body of the Amœba begins to decrease in size, its rounded outlines disappear, and in a short time after the capture it is reduced to a shapeless mass of flat and wrinkled ectosarc, the endosarc having been completely sucked away with the exception of the remains of diatoms and other objects too large to be drawn through the tentacular canal. The investment of ectosarc is then discarded, and the tentacles withdrawn and made ready for other victims.

The above observations were made with a one-fifth objective. A one-twelfth immersion objective yielded still more interesting and instructive results. As good fortune would have it, the Acinetan under observation almost immediately captured two Amœba. One was caught at first by one tentacle only, which was then partially retracted, when several other tentacles curved around and grasped the prey in a close embrace, at the same time applying their several suckers, which seemed to be pressed out flat against the outside of the Amœba. In a few seconds the ectosarc was pierced, when suddenly a rapid stream of granular protoplasm was seen flowing down the interior of the tentacles and into the body of the captor. So strong was this current that the particles flowing through the tentacles were forced in a rapid stream some distance into the parenchyma of the Acinetan, while in the body

of the Amœba the suction was so strong that particles were seen to rapidly converge from all directions to the points where the suckers were applied.

After exhausting the contents of the Amœba, one of the tentacles was seen to *violently eject a stream of granular protoplasm.* This was twice repeated, but the last time the act followed a slight pressure on the cover glass. On no other occasion was this ejection observed, but the query at once arises—Are these suctorial tentacles at times excretory in function?

This seems hardly credible in view of Huxley's statement, "Solid food is not ingested through these tentacles" (Anatomy of Invertebrated Animals, Am. Ed., p. 94), but a subsequent observation removed this difficulty. On this latter occasion a Ciliated Infusorian rapidly crossing the field came in contact with one or more of the extended tentacles of the Acinetan, which immediately grasped the victim, and held it in spite of its violent struggles. Four incisions were made in the ectosarc of the prey, and soon four rapid streams of protoplasm were passing into the body of the captor, rapidly exhausting the endosarc of the Infusorian, although its cilia continued in motion long after the animal was reduced to a mere fraction of its former proportions. During this process *solid colored granules* were seen to pass from the body of the victim through the tentacles and into the body of the Acinetan. This observation was verified upon at least one other occasion.

The ingestion of solid food would seem to render an excretory organ necessary to the Acinetan, and if this is so it seems at least possible that the suctorial tentacles may serve the purpose.

In regard to the manner of ingestion of food by the Suctoria, several of the leading authorities, including Maupas and Kent, hold that there is a double current of protoplasm in the tentacle, one of granular protoplasm passing into the body of the Acinetan, and another of colorless sarcode passing in an opposite direction. The writer has failed to find any evidence of the latter current, although his purely negative testimony is of little weight. Still the question might be pertinently asked: Why does not this colorless stream, pouring into the body of the victim, produce a current among the protoplasmic granules of the latter, which is directed *away* from the distal extremity of the suctorial tentacle? A number of observations under favorable circumstances failed to disclose the existence of any such currents, although strong currents toward the point of incision were always distinctly seen.

The structure of the suctorial tentacles, as described by Kent, is that of a hollow tube traversed internally or externally by a spiral filament or granular crest, which appears as transverse striæ when the organ is fully retracted. The writer has in vain attempted to assure himself of the correctness of this view as regards the species under consideration. It may be that a higher magnification would reveal the structure above alluded to, but a one-twelfth immersion objective[1] used under favorable conditions of light, etc., and repeated observations have shown what seems to be merely a *coiling and uncoiling of the entire tentacle*, without any indication of the large central core figured in Plate xlviii., fig. 22, of Kent's Manual of the Infusoria. The extension and retracting of the tentacle appears to be effected by the uncoiling and recoiling of the whole organ.

In working out the method of reproduction of this species, the writer was at first entirely misled by discovering a specimen with embryos clustered around its anterior end as represented in fig. 4. The resemblance of this to the exogenous gemmation said to be common in the genus *Hemiophrya*, at least, and figured in Plate xlvii., fig. 8, Kent's Manual of Infusoria, was so striking that there seemed hardly a doubt as to the interpretation; and had no more observations been practicable, the species would have been described as reproducing by exogenous gemmation. The question naturally arises: May not others have been misled in a similar way, and may not exogenous gemmation be much more rare among the Suctoria than has been commonly supposed?

The life history of this Acinetan discloses the following stages, several of which merge almost insensibly into each other:

1st. The parent form suffers the loss of its suctorial tentacles, which seem to shrivel up and gradually disappear. Fig. 3.

2d. Internal embryos of a round or oval shape make their appearance in considerable numbers in the endosarc of the animal. Fig. 3. This process is accompanied and preceded by an unwonted activity in the granular protoplasm of the parent.

3d. These embryos escape through the anterior portion of the

[1] Since writing the above, satisfactory observations have been made with a magnifying power of 1600 diameters, which have confirmed the view here advanced. Indeed there seems no room for doubt so far as the present species is concerned, whatever may be the facts in regard to others.

ectosarc of the parent, but remain for some time just outside of the latter, and apparently attached to it either by a sort of plasma or by short stalks. Fig. 4.

4th. The embryos develop cilia and swim away as free, ciliated embryos. Fig. 5.

5th. The ciliated embryos become fixed to some object and acquire a triangular shape and a few (three or four) suctorial tentacles at each antero-lateral angle. At about this time the single anterior contractile vacuole appears. Fig. 6.

6th. The animal now grows longer, and gradually acquires more suctorial tentacles until the adult form is reached. The development is illustrated in figs. 7, 8, 9, 10, 11, none of which are hypothetical, each having been observed by the writer.

Fig. 2. represents an individual of nearly twice the ordinary length, showing two transverse constrictions or markings of the ectosarc. In this, as in most other specimens examined, the animal is largely obscured by various objects, which seem to adhere to its surface as if it were covered by a viscid substance.

AN INQUIRY INTO THE STATE OF EARTH'S INTERIOR.

BY IRA SAYLES.[1]

THERE seems to be a strangely broad difference between the conclusions of the geologists and the physicists on the condition of Earth's interior. This broad difference, therefore, invites every thinker to think for himself, and to conclude as best he may be able. As a thinker I enter the lists.

It is manifest, from a bare inspection of the question at issue, that it demands both the inductive and deductive processes of ratiocination. Inductively, the fact of heat must be established, its extent established, and its persistence established: deductively must its maximum be reached, it effects be reached, and the main results of these effects be reached.

[1] U. S. Geological Survey.